POPULAR MECHANICS

An Illustrated Weekly Review of the Mechanical Press of the World

"Tells you how to do things." Written so you can understand it.

Vol. 3. No. 4. CHICAGO, JANUARY 24, 1903. PRICE 5 CENTS.

Royalty Opens the Great Assouan Dam

The Khedive of Egypt, the Duke of Connaught and Others of the Nobility Traversing the Dam on Trolleys

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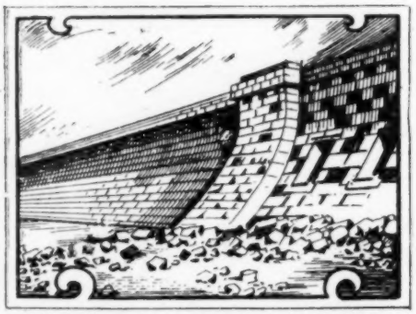
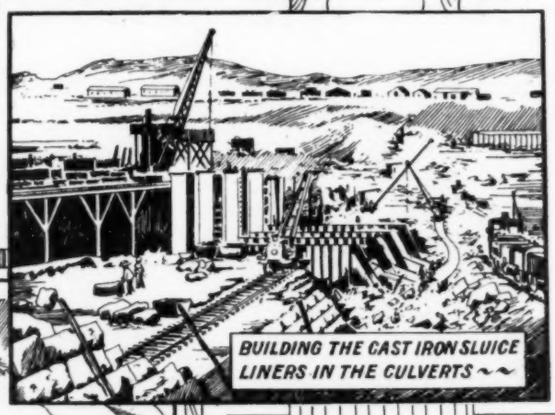
JAN 22 1903
SMITHSONIAN REPORT

THE NILE DAMS

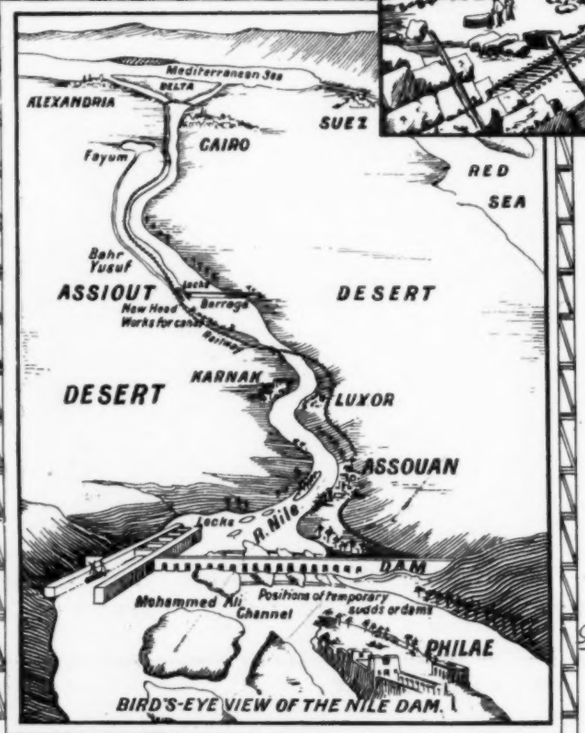
ASSOUAN AND ASSIOUT



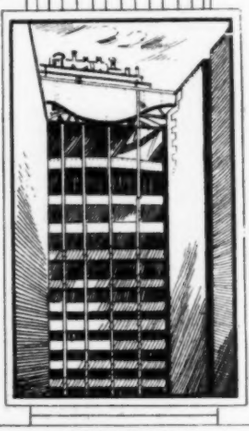
~ THE GREAT WALL OF GRANITE AT ASSOUAN ~



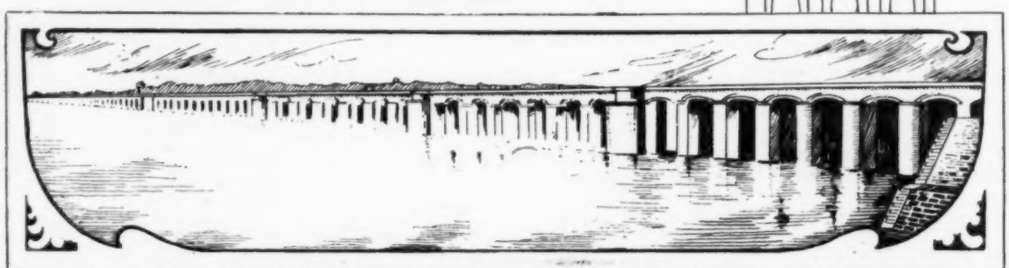
BUILDING THE CAST IRON SLUICE LINERS IN THE CULVERTS ~~



BIRD'S-EYE VIEW OF THE NILE DAM.



~ LOCK GATE ~



~ THE SUPPLEMENTARY BARRAGE AT ASSIOUT ~

Opening of the Assouan and Assiout Dams

Turn of a Silver Key Sent the Waters Surging Down the Nile and Reclaimed Egypt

With a turn of a silver key at the starting switch of the motors the pent-up flood was released and in great jets went bounding and roaring through the sluices of the Assouan dam, and vast deserts of Egypt were reclaimed. On rushed the flood, surging and tearing over the rocks, the spray mounting to the top of the dam as royalty that had performed the impressive ceremony shouted in exultation. The silver key—it was called "the key of the Nile"—that opened the flood gates was turned by the Khedive of Egypt. It bears the inscription:

"Opening of the first sluice of the Assouan dam by His Highness the Khedive, in the eleventh year of his reign, Dec. 10, 1902; presented by Ransom & Rapier, makers of the sluices and lock-gates."

The five sluices were completely opened in seven minutes after the key was applied to the starting switch of the first sluice.

Among the others who participated in the ceremony were the Duke and Duchess of Connaught, the Earl and Countess of Cromer, Herr Von Mueller, the German diplomatic agent, and other specially invited guests. The foundation stone was laid by the Duchess of Connaught at the special invitation of the Khedive. An investiture was held by the Duke of Connaught at which high degrees of honor were conferred on the promoters and engineers in charge of the work.

The Assouan dam, which has been previously described in Popular Mechanics, is regarded as one of the greatest engineering feats in the history of the world. The works were constructed at a cost of $25,000,000 and will, it is estimated, increase the annual wealth of the country by nearly $12,500,000. The value of the government lands which have been reclaimed will be increased by nearly $5,000,000. About 800,000 acres of basin land will be converted into "sefi," or land where summer crops can be grown, which it is estimated will yield an increase of 25 per cent in the production of long staple cotton in Egypt.

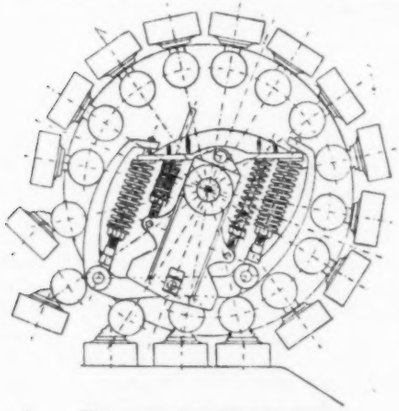
The Shipping World of London says: Assouan, the site of the large dam, is about 460 miles above Cairo. The foundations of the wall are laid in a deep trench cut into the granite of the river bed. The presence of the granite at this spot and the converging of the hills made it the most favorable for a site. The four locks of the canal permit of river traffic for sailing vessels and steam vessels at any level of the water.

Two hundred and seventy miles below Assouan is the supplementary dam at Assiout. The dam at Assouan has 180 main sluices and 150 low-water sluices closed by steel gates, through which the river can flow. The whole work of building was accomplished by cutting off the water from between two islands by temporary dams and then pumping the space dry. The dam is 60 feet wide at the top and a mile and a quarter in length and is surmounted by a roadway. About 100,000,000 tons of water are impounded behind the dam, and when the sluice gates are opened at high water 900,000 tons of water will rush through them every minute. The lowest level water ever reaches at Assouan is 279 feet above the Mediterranean sea level. The dam will hold it up to 347½ feet above the same level. A reduction of 8 feet was made in the height of the dam as originally designed in order to save the temples on the island of Philae, which would otherwise have been completely submerged.

Traction Engine That Walks

Strange Footed Vehicle Climbs Stairs, and Pauses Not for Ruts, Stones or Timbers

Here is a traction engine which actually and literally walks upstairs with the stride and sure-footedness of an elephant and hauls loads behind it under circumstances which would nonplus an ordinary traction engine. Ruts, curbstones and boulders it makes nothing of, and even nine-inch beams of timber are as stubble before it. It is an English invention, and is called the Pedrail. The Automotor Journal of London says:



Mechanism of the Engine's Foot

The Pedrail consists of a rail somewhat in the form of an inverted heart, round which passes in succession a number of small wheels or rollers, each carrying a circular foot. Imagine a number of steel spokes to be all that remain of the ordinary wheel, each of these steel spokes having one of the rollers with the foot attached mounted on it. When the engine drives the axle carrying the spokes these feet are placed in succession upon the ground with the roller upward. The lower part of the heart-shaped rail slides upon the roller which it finds beneath it until it has passed off the roller, which is then picked up and carried over to the front part of the rail in order to take its place again in supporting the vehicle.

Walking Traction Engine

CARBON PAPER MAKING A CAREFULLY GUARDED SECRET.

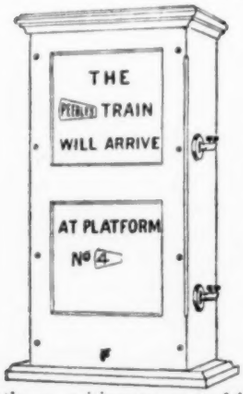
Editor Popular Mechanics: Please explain an inexpensive way of making good tracing or impression paper, suitable for typewriter use.

The making of carbon paper and typewriter ribbons is a trade secret known to scarcely two dozen people in the world. It has been handed down from father to son for probably a century. So carefully is the secret guarded that the process has never been patented. The method is said to be so very simple and inexpensive that any one could easily manufacture it if only the secret of the composition were known. Much money and time have been spent in endeavoring to make the valuable discovery, but all to no avail. The secret yet remains with the original discoverers and certain members of their families.

A company is being organized in Miami, Florida, to can and smoke kingfish as a competitor to salmon.

TELLS WHERE THE TRAINS ARRIVE.

An English railroad has recently put in all its large depots a most sensible indicator to tell on which of the many platforms a certain train will unload. As it is now in our big ciy depots there are from six to twenty, and in some even more, tracks, and which one an incoming train will take is generally known only to the switchman. The result is people rush from one platform to another, usually finding the right one about the time the passengers have all left. Our cut from the Railway Review shows a platform indicator "written so you can understand it." It is operated with electricity by the switchman and flashes its message in ample time for those waiting to meet friends to be at the right place in time.



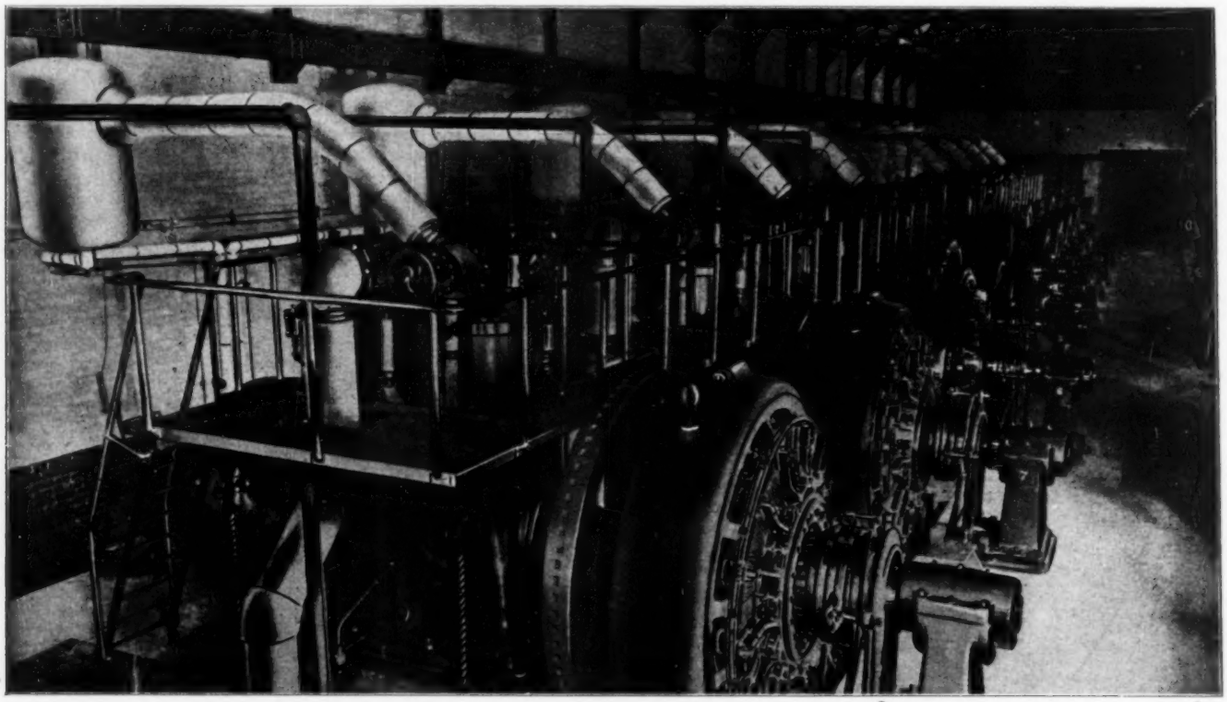
ELECTRIC RAILWAY SERIES, PART III.—THE ENGINE ROOM

Where the Triumph of Mind Over Matter is Seen in the Perfect Control of These Gigantic Power Producers.

The stillest place on earth is a great power station when all the engines are shut down in the early hours of the morning, for a brief rest and inspection. No matter how often you may have experienced the event, it is always new. The throb and pound of the engines, the whir of the electrical machines, the hiss of a leaking packing, all these grow fainter and weaker like the dying breath of some fierce monster. Then all is still—oppressively still. A workman drops a wrench on the concrete floor and it sounds like the blow of an avalanche.

Little wonder a child worships an engine, and few of us ever grow too old to enjoy seeing the wheels go 'round.

Last week we were in the boiler room and saw where the steam pipes were lost in a big thick wall. This week we show the engine room of the Detroit, Ypsilanti, Ann Arbor & Jackson Ry., with the same pipes coming out from the wall and



Interior of Engine Room—Ten Engines in Operation

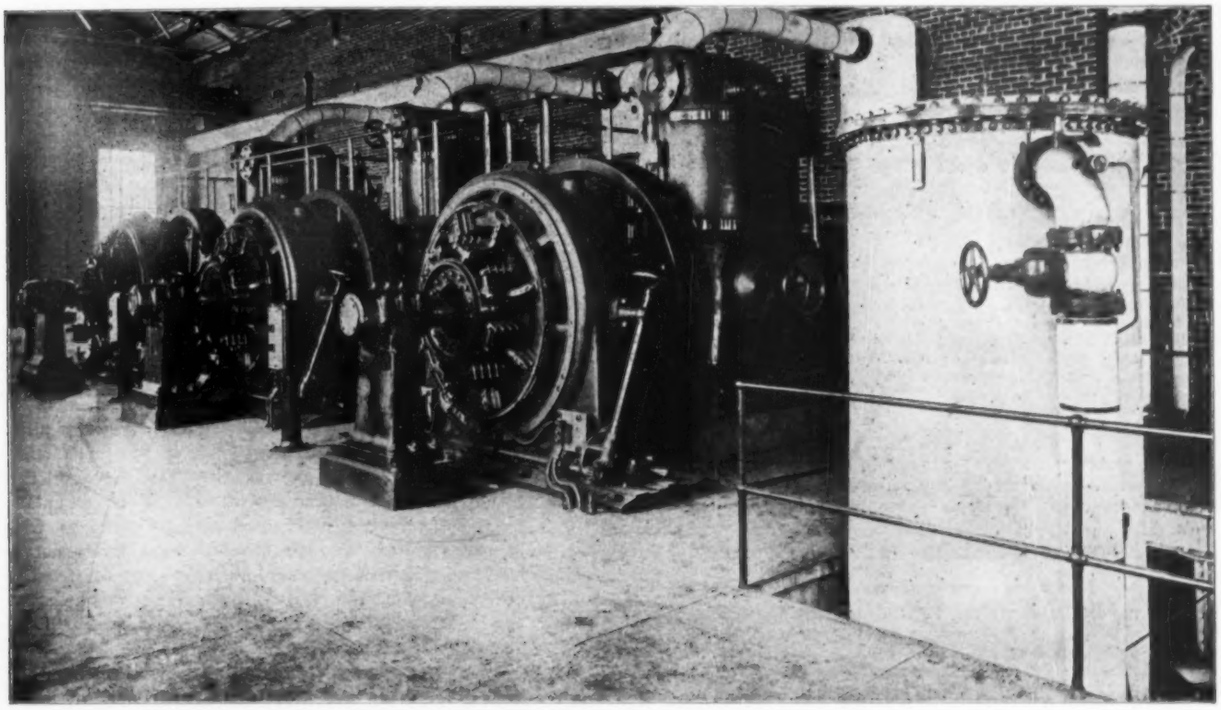
leading to the engines. A road with such a big name requires ten engines to generate the electricity for its stretch of territory, 77 miles long. These engines are of the upright type, built by the Westinghouse company, and are direct connected. That is, the engine and generator are connected to the same shaft, thus doing away with belts. The steam enters through the white pipe above the engine, and exhausts into the pipe which is seen passing down through the floor. The electric generator is the machine at the right of the engine, while the flywheel is placed between the two. The holes in the face of the flywheel are to insert a heavy iron lever, by means of which several strong men can cause the machinery to turn slowly while repairs are being made after the steam has been cut off. The men who do this do not care much for a gymnasium. The wheel at the top of the engine works the valve which admits steam to the engine. When this wheel is turned in the direction the hands of a watch travel, the pipe is closed, the steam shut off and the engine stops.

The illustration on the opposite page shows another power

GROWTH OF THE CORRESPONDENCE SCHOOL.

Into a school as big as is industrial America the American School of Correspondence has broadened since it began its meritorious work of teaching technical knowledge by mail. Nearly every state in the Union is represented in the great list of graduates contained in the school's catalogue of 1902, and even this is but a partial list, as it was impossible to bring it up to date. The affiliation of the school with the Armour Institute, the greatest technical school in America, was a recognition of education by correspondence which has given it a prominence many never before dreamed it would attain. The facts contained in the catalogue, together with the words of praise spoken by leading educators show a wondrous awakening of the present generation to the advantages of this method of education and of the great good it is doing in our country in the way of affording thorough technical education to the hundreds of workingmen and others whose opportunities will not permit of their attending a regular technical school.

station—a smaller one—in which the same type of vertical engine is used. The white object at the right is a steel tank, where the exhaust steam from the engines is made to heat water which is then pumped into the boilers. The hotter this water becomes

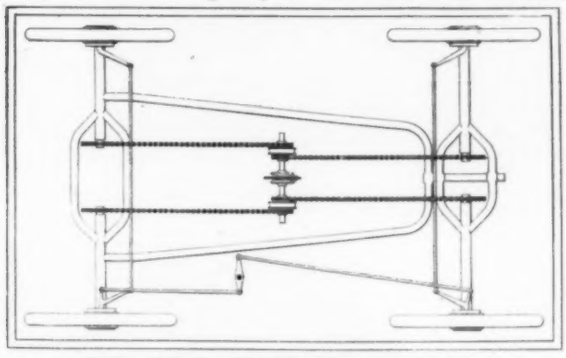


Interior of Engine Room—Showing Water Heater

the less coal the man will have to burn to convert the water into steam.

FOUR-WHEEL DRIVE FOR AUTOS.

The accompanying cut from the Automobile Review requires no explanation, being a plan to make all four wheels driving wheels, instead of using only the rear wheels as heretofore.



RUNNING GEAR OF COTTA FOUR-WHEEL DRIVE RUNABOUT.

The new feature is the arrangement by which the rear wheels turn at the same angle and at the same instant as the front wheels, thus keeping the driving chains always tight upon the gears.

SEVEN-MASTER TOO BIG.

There can be too much of a good thing. The Lawson, the seven-masted schooner, and the largest afloat, has been unable to load within 1,500 tons of her capacity. The channels at Baltimore and Philadelphia are too shallow, and there are only three piers in Boston where she can unload.

HANDLES GRAIN AUTOMATICALLY.

In a warehouse in Walla Walla there is a new contrivance for the piling of sacks of grain. It is calculated to do the work of four men, and, to a person watching, it would seem that it does the work of seven or eight. The machine in question is a portable elevator with three sack carriages that work on the same principle as the elevator of a threshing machine, namely, on a reel, says Enterprise.

It can raise sacks any height from seven or eight feet up to about fifteen, and does it with an easy quietness that makes it all the more desirable for the purpose for which it is used. The power for this machine is furnished by a one and one-half horsepower gasoline engine. A windlass is arranged so that the elevator can be raised or lowered by merely turning a crank. The whole thing can be moved from place to place by one man, and it has the capacity of lifting 500 bags of grain an hour. The engine once properly started will take care of itself, and with four men can handle sacks as fast as they are put on it. Two men are placed at the top of the pile and two at the feeding place on the elevator. These are the ones who load the sack carriages as they come around, the two men at the top receiving them as fast as they come up. In this way the work that can be gone through with in a day is surprising. The old way of passing sacks from hand to hand until they reached the top of the pile is eliminated, and the bags reach the top at once and by direct route.

ELECTRICITY INSTEAD OF SOAP.

A man in Buda-Pesth has invented a washing machine which dispenses with soap and uses an electric current to remove dirt, grease and stains. The inventor is Josef Nagy, of Szegedin, and the foreign papers say the device is a success.

Naurer, a German inventor, has completed an automobile which he claims solves the problem of obtaining simplicity, endurance and good uphill speed.

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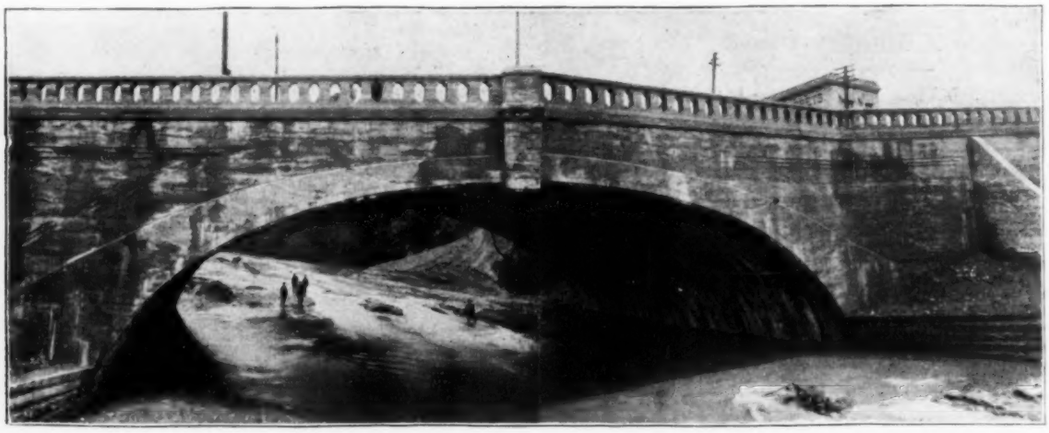
CONCRETE BRIDGES GAIN IN FAVOR.

Graceful and Desirable Arches That Span Streams in France and America.

France is not the only country that can boast of the graceful, picturesque and durable concrete bridges. They are becoming very popular in this country, several of them now adorning the parks in Chicago and on the Pacific coast they are being used to span streams along the roadways. The accompanying illustration shows a fine example of this style of bridge.



Concrete Arch Bridge at San Leandro, Cal.

The Railway Review says: "This is an elliptical arch bridge, at San Leandro, Cal., built last year by the E. B. and A. L. Stone Company of Oakland, Cal. The span of the arch is 81 feet 3 inches; the height 26 feet and the width 66 feet."

NEW CARS LAST YEAR.

The reports of the rolling stock ordered in 1902 now at hand show the following remarkable numbers: Freight cars, 195,248; passenger cars, 3,459; locomotives, 4,665. Twice as many locomotives could have been sold if there had been shops and men to build them.

ARE DIAMONDS IMPORTED FROM OTHER WORLDS?

Said to be Shipped to the Earth on Shooting Stars Through Millions of Miles of Space.

Diamonds are not indigenous to the earth. The person who wears daimonds is wearing stones that are brought from some distant orb of the universe. They are the only article of man's use that are "imported" from other worlds than ours. Genuine diamonds come from the stars. They are not transported in airships or balloons, but are sent to us through the millions of miles of space, with the swiftness of a shooting star, in meteors that often bury themselves deep in the ground. This is all according to the claims of an American scientist.

The finding of diamonds in a meteorite that fell in Arizona led to the remarkable discovery. This meteorite was of gigantic size, which long ago struck the earth and buried the greater part of itself out of sight, leaving some broken fragment on the surface. The rock hollow the meteor formed was at first believed to be a volcanic crater, but the fact that no volcanic product could be found in the vicinity disproved this theory. Further investigation has shown that the diamonds of the famous Kimberly mines, which at present furnish nearly all the world's supply of the gems, are imbedded in just such craters as this one found in Arizona and that they were deposited there years ago by the impact of immense meteors. This accounts for the manner, hitherto not understood by geologists, in which diamonds are scattered through drift of many kinds not apparently related definitely to other minerals.

Thus the man who is first enabled to overcome the atmospheric conditions and explore the distant worlds, may find a sphere that sparkles with the carbonaceous stones.

As diamonds are so nearly of the same chemical constitution as coal, which must be made by vegetable organism, it is now contended that there must be vegetable life in the worlds from which they come. If this be true it is a strong reason for thinking that there is also animal life.

TO DISPOSE OF SOOT.

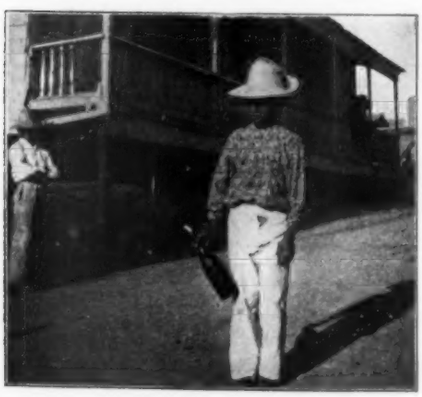
Owing to the trouble caused by soft coal clogging pipes and chimney flues, the following suggestion is worthy of noting: "Zinc is a peculiar metal in many respects. It volatizes easily, and the oxide thus produced has a strong affinity for carbon. If one's furnace chimney is clogged up with soot and the owner desires to get rid of it, all that is necessary is to throw a little zinc scrap into the fire. Any old zinc will do, and very little will suffice to keep the chimney clean if used about once a week. The vapor of zinc oxide seizes upon the carbon of the soot and forms a new chemical compound, part of which goes up the flue and part falls to the bottom to be shoveled out as ash."

PURIFICATION OF RIVER WATER.

In his investigations of this subject, Professor Leighton of the geological survey has found the old-time notion that the purification of water in a river is due to aeration and the tumbling incident to a more or less rapid current to be erroneous. It has been found, in fact, that organic matter in a flowing stream is not assisted in its oxidation by agitation of the air. On the contrary, the experiments of Professor Leighton show that the highest degree of activity in oxidation, or purifying process is to be found in quiescent or stagnant waters. These conclusions have also been confirmed by the experiments of the Massachusetts state board of health.

COLD CREAM MAKES BEST BUTTER.

Cream intended for churning should be cooled to a temperature of 45 degrees, or less, says the Creamery Journal, and the cream should be exposed to the low temperature at least two hours before churning. To churn immediately after it has been cooled from a high temperature is but little better than to churn at a high temperature without cooling. It takes time for the fat globules to become thoroughly chilled. If the cream is at a high temperature in the morning, do not let the coming heat of the day lure you to churn in a hurry. If the cream is thoroughly cooled the butter will "stand up" well while it is being worked, even during the heat of the day. Keep the temperature of the cream as constant as possible during the ripening, for every sudden change will leave bad effects upon the texture of the butter, and butter made from cream which has seen several sudden changes in temperature never "stands up" as well when exposed to an atmosphere varying in temperature. When the cream is almost ripe it should be cooled to below 50 degrees Fahrenheit, and left under conditions which will maintain this temperature until it is churned.

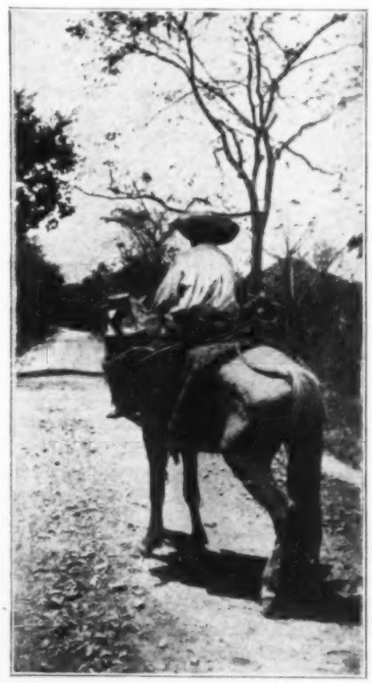


Delivering Milk in Aibonito.—From Raymond A. Pearson, United States Department of Agriculture

Crude Dairies in Porto Rico

Little Attention Paid to Sheds, Wagons and Other Mechanical Equipment

A fortune probably awaits the American who will establish a first-class dairy in Porto Rico near one of the larger cities and provide it with modern mechanical equipments such as characterize the dairies in this country. Mechanics play an insignificant part in the present Porto Rican dairy. The sheds in which the cows are kept are the crudest of structures. Cows are milked in pens near each of which is a swing gate leading into another pen where the calf is taken after it "starts" the milk. The Porto Rican has never learned that the calf should be removed from the cow entirely within two or



Taking Milk to Coamo.—From Raymond A. Pearson, United States Department of Agriculture

three days after it is born and raised on skimmed milk and meal, milking the mother twice a day. They believe it is absolutely necessary for the calf to remain with the cow. The fact that when a calf is lost the cow is liable to soon go dry is taken as proof positive that the calf cannot be dispensed with.

The milk cans, milk wagons, and in fact all the mechanical equipment of the dairies, are antiquated in the extreme. The milk wagons are merely ox carts. The cans hold 12 or 15 quarts and are stopped with covers of banana leaves. Instead of being placed in the carts these cans are often carried on horses or by hand as shown in the accompanying illustrations. The milk is distributed without cooling as promptly as possible after milking, and in the larger cities some is left in little milk shops and grocery stores. The latter is boiled soon after it is received and sold in small quantities as called for. If not sold in a few hours it is boiled a second time. While awaiting sale it is often allowed to remain

Delivering Milk in San Juan.—From Raymond A. Pearson, United States Department of Agriculture

in an open vessel near an open door or window surrounded by odors of native cheese, fruits and vegetables and uncleanliness indoors and out. In many instances the cow is driven through the streets and milked at the door of the purchaser in quantities as desired as long as the milk in the cow holds out.

AMMONIA AS A FIRE EXTINGUISHER.

Some interesting instances of the power of ammonia as a quencher of fires were given in a recent issue of the National Druggist. In one instance, where fire had originated, probably from spontaneous combustion, in a pile containing several tons of cotton seed, and the interior of which was almost a solid body of live coal, a half gallon of ammonia completely smothered the fire. In another, which occurred in Savenay, France, the vapors of a tank containing fifty gallons of gasoline caught fire in the linen room of a laundry. The room was instantly a mass of living flames, but a gallon and a half of ammonia water thrown into it completely and almost immediately extinguished the fire. The ammonia was in glass demijohn in an apothecary's shop next door to the laundry, and was thrown into the room by the druggist as an experiment. To use his own words in reporting the circumstance: "The effect was instantaneous, torrents of black smoke rolled upward in place of flames, and in a moment every trace of fire was gone. So completely was the fire extinguished that workmen were enabled to enter the room almost immediately, where they found the iron tank of gasoline intact."

Easy Electrical Experiments

By L. P. Dickinson

THE DESIGN OF A SMALL DYNAMO.

One of the most common problems that the amateur meets is the problem of the proper design of small dynamos and motors. In the following chapter an attempt will be made to explain the methods and principles involved, and the various steps in the calculation will be gone over. It will be assumed, however, that the reader has a fair knowledge of electrical terms, and a familiarity with the essential parts of a dynamo or motor.

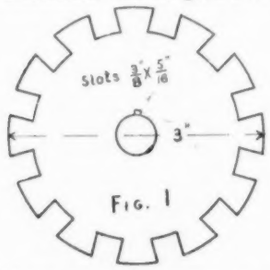


Fig. 1

First of all we must assume that we are to build a machine that will give us, when run as a dynamo, a certain output in watts. The machine to be described will have a maximum output of 75 watts at a pressure of 50 volts. We are obliged to rely for our starting point upon the experience gained by others. It has been found that for this type of machine a speed of 2400 revolutions per minute is a good value to use; also that a velocity of the conductors upon the armature of 30 ft. per second is about the highest we can go with safety. Knowing these two things, it is easy to calculate the size of our armature. If we multiply the speed at which the conductors move (30), by 12, and divide the product by 3.14 and again by the number of revolutions per second (40), the result will be the diameter sought. In this case the product of 30 and 12 is 360. Dividing this by 3.14 gives 114.6. Dividing again by 40 gives 2.865 as the diameter of the armature we are to use. This is very nearly the same as 2⅞ inches, and is the average diameter of the armature, measured to the center of the conductors. The outside of the armature should be a little larger than this. To use even figures, let us assume the outside diameter of our armature to be 3 inches.

In the design of armatures for large machines, a less number of revolutions per minute must be chosen. A machine of ½ horse power (373 watts) should have a speed of about 2200 revolutions per minute. A one-horse power dynamo should run at about 2000 revolutions per minute, and a two-horse power dynamo is usually run at about 1800 revolutions per minute.

The armature which we will use will be of the toothed type, shown in Fig. 1. The actual number of slots used is immaterial, if it is only an even multiple of the number of commutator segments to be used. We will choose twelve slots and twelve teeth for our armature. The number of commutator segments varies with the voltage to be employed; and also with the current generated. Of course, the number of segments should be an even number, and is almost always some multiple of 3 and 2; e. g., 12, 18, 36, etc.

Since ours is a low voltage machine a very few segments will suffice, as far as insulation goes. But it must be remembered that the greater the number of segments the smoother will be the current generated. On general principles, not less than six segments should ever be used, and for machines of 110 volts and upward, twelve or more segments should always be used. Because of ease of construction, we will choose six commutator segments for our machine. The above remarks apply to machines with one pair of field poles. Machines with two pair (4 poles) will require double the number mentioned.

The conductors wound upon the armature will lie closely packed in the slots. Imagine that we have built our armature, and could cut it open directly across the conductors. How many conductors could we count? This is the next question we shall answer.

Their number depends upon their size, of course, and their size depends upon the current they are to carry.

Now if the output of our dynamo is to be 75 watts at 50 volts, the current generated must be 1½ amperes. Usually we have to allow also for the current which supplies the field coils, assuming the latter to be in shunt with the armature. In this case we will assume that the field current has a value of ½ amperes. It is usual to allow in small machines an area of 400 circular mils per ampere, in determining the size of wire on the armature. On larger machines (1 to 2 kilowatts), at least 600 circular mils per ampere should be allowed. Our machine will have a drum armature and will therefore have two parallel circuits through the armature. So that each conductor carries one-half the above current, or one ampere. Therefore the conductors on our armature must have an area of 400 circular mils. This means that we must use No. 24 magnet wire upon the armature. This, when insulated with double cotton covering, has an outer diameter of .03 inches.

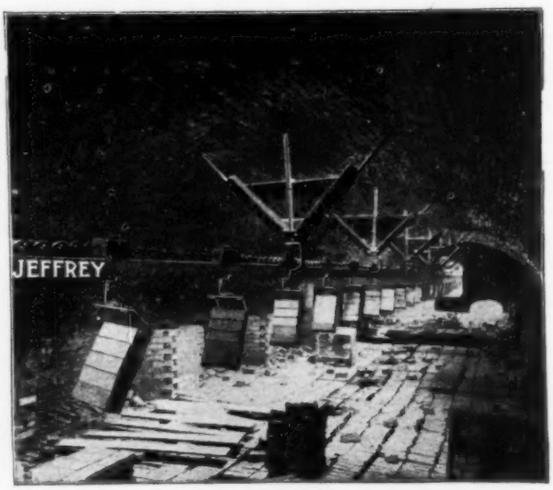
The width of our slots if they are to take up one-half of the circumference of the armature is ⅜ inch, and if they are 5-16 inch deep, it will give us a well proportioned tooth. Assuming these dimensions, we can have eight layers of wire in each slot. This allows 1-32 inch for insulation at the bottom of the slot, and 1-16 inch clearance at the outside, which will be necessary for binding wires. Assuming the same thickness of insulation on the sides, we can get 11 turns in each layer. So the number of conductors in each slot is the product of 11 and 8, or 88; and the total number of conductors in all slots is 88 times 12, or 1056.

We will continue the design of our machine in a following chapter.

(Continued in issue of Feb. 7.)

NOVEL BRICK CONVEYOR.

The man who had nothing to do but carry up bricks to the other man, who did all the work, is fast losing his job. In building skyscrapers all the material is hoisted in elevators, and now comes a conveyor for distributing the brick along the wall where wanted. It is made by the Jeffrey Company, and



The Brick Conveyor

the conveyor shown in our illustration is removing brick from a kiln where they were burned. The trays are filled, hung upon the endless chain belt, and emptied automatically at the desired point. The conveyor is in sections so it can be shortened or lengthened as wanted, and moved about and set up with little loss of time.

HOW TO BUILD A SHEET METAL BOAT.—PART II.

By Martin L. Kaiser

The sheet metal boat which is destined to afford you great service and pleasure in hunting and fishing for many years to

come is now nearing completion. In the last issue was described the construction of the boat up to and including the riveting of the end parts. The wood strips forming the gunwale should now be fastened to the top edge of the boat as shown in Fig. 4, so as to make a smooth, safe

Fig. 4.—Cross Section, Showing Gunwale and Bottom and Side Stiffening Boards.

finish and to give strength. The strips may be of clear white pine, the inside strip being made flat on one side and the corners rounded on the other, and ½x1½ inches in size. The other strip should be 1x1½

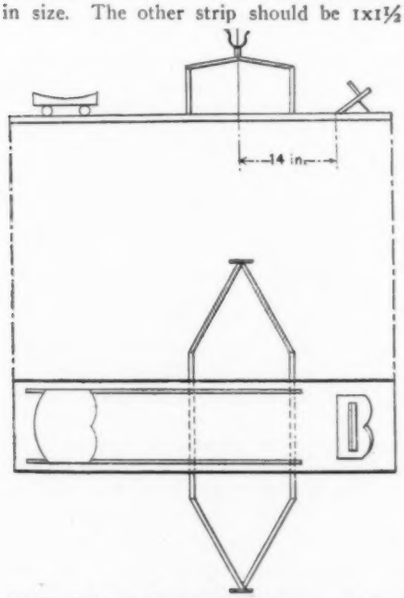


Fig. 6.—Bottom Board with Sliding Seat and Outriggers.

inches, formed in the same way. The screws should pass through the inner strip and the metal side of the boat and have a firm hold in the outside strip.

The flat side and almost flat bottom must be stiffened, which may be done as follows: Two pieces of clear pine siding may be fitted lengthwise of the boat, with the thick edges adjoining, and the remainder of the width of the bottom supplied with pine strips, shown in Figs. 2 and 3. A strip of pine of the same thickness as the inside top rail, and 1½ inches wide, is fitted along the length of the boat about half way up each side. These bottom and side pieces are held in place by means of two 1x1⅛ inch irons chamfered on the edges, bent as shown in Fig. 4, and fastened to the wood strips with 3-16 inch bolts and washers. The bottom pieces of the floor should be spaced about ¾ inch apart, in order to allow the water to be more easily drained out of the boat. The wood strips should be painted before being finally fastened in place, as also should the inside of the boat.

For use with the paddle, a good seat with adjustable back may be made as shown in Fig. 5. The seat board is continued back to form a tongue, to which is hinged the post which holds the back board in po-

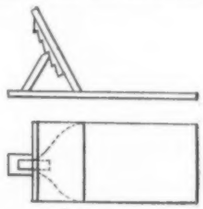


Fig. 5.—Plan and Elevation of Paddling Seat with Back.

sition. The back board is also hinged to the seat board, and has, screwed to the under side, a strip of galvanized strap iron to form a series of steps against which the adjusting post bears at any desired inclination. A loose cushion may be used to soften up things a little.

For rowing, a bottom board, with roller seat, foot piece and iron oarlock outriggers attached, should be made, so that it can be easily lifted out or placed in the boat for use as desired. A plan and side elevation of this fixture is shown in Fig. 6. It is made of white pine board 12 inches wide, 1¼ inches thick and 4 feet long. At one end the foot rest, with toe straps, should be fixed, and at a point which will bring the center of the oarlocks 14 inches from the back of the foot rest the outrigger irons should be fastened. They should be made of two pieces of ⅝-inch round iron, flattened where they are fastened to the board, and they should be let into a suitable groove, so as to be flush with the bottom surface. The outer ends should outboard about 12 inches, where they should be welded together and finished with a socket for the oarlocks. At the other end of the board guiding strips for the roller seat should be fastened and faced with strips of hard wood to take the wear. The seat should be fitted to the user from a 7-inch square block to which rollers, that can be bought at any hardware store, can be attached. The space between the strips is governed by the width of the seat and the location of the rollers. This rowing seat may be changed to face either way, to avoid turning the boat around or to adjust the weight in the boat to suit the load.

In conclusion, I wish to say that my experience with locked and grooved seams, soldered heavily on both sides, has proved very disappointing in a boat built previously to either of the successful boats I have made, whereas no trouble whatever has been experienced with close riveted seams used in the later built crafts.

ELECTRIC POWER IN THE ROLLING MILL.

Everything except the heavy rolls that shape the steel is electrically operated by the mere movement of levers. The requisites for the work are a sure eye, a prompt hand and a clear head, says the Engineering Magazine. In the pulpit that gives a commanding view of the rolling and conveying machinery, and at the various machines, are a few operators. The red-hot steel passes into the rolls and, rushed back and forth on electrically driven rollers, it lengthens with each pass until finally it runs out a thick bar about thirty feet long, when a set of transfer arms picks it up and throws it bodily to a second set of rolls in line with the first set—much as a row of men standing in line would toss a plank back over their heads. In this set of rolls the steel bar, under the gentle press of the roll quickly reaches a length of 100 feet. Just beyond, a third set of rolls receives the rail and finishes it off into its final and familiar T form.

From the finishing rolls, on electric rollers, the long rail passes to the hot saws. A touch of the lever, and rapidly rotating saws, electrically driven, cut the rail in three pieces, each thirty feet long. From the saws, the rails pass one at a time to the "curver," a machine that is adjusted to put just as much arch into the rail as gravity can remove during the cooling period. From this point the rails pass out on the "hot-bed," a skid constructed of rails and provided with electrically moving clutches. In groups of four or five, the rails go to the electric straightening presses, and then finally to electric drill presses that pierce the holes through which the rails are afterwards bonded together. Lastly, a motor-driven rail conveyor carries the finished rails out to the shipping skids. They are ready for the markets of the world.

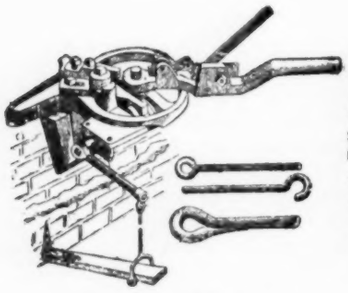
"Wisdom," says Uncle Gabe of Mobile, "is knowin' how to keep folks from findin' out wot a blame fool you is."

SHOP NOTES

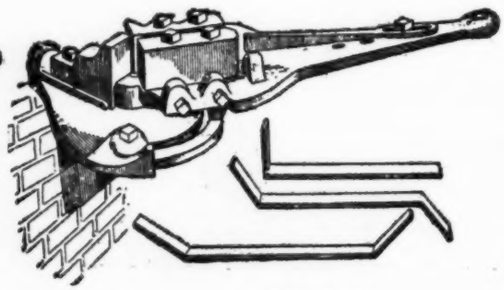
SIMPLE HAND BENDING TOOLS.

Hand bending tools are gaining in favor because of the many conveniences they afford in the shop. They are simple and can be operated by any blacksmith or helper. The eye bender herewith shown, bends hot stock and turns out perfect eyes and hooks, uniform in character and size. The system of gripping the stock and carrying it around a forming pin enables the operator to turn eyes on the ends of long rods. The machine takes stock up to ¾ inch, and bends rings and eyes up to 3 inches outside diameter.

The angle bender bends flat stock up to 2 inches wide by ⅜ inch thick, and round or square stock up to ¾ inch. Many light jobs can be bent cold. These tools are manufactured by the Wallace Supply Co., Chicago. Both the angle and the eye benders are secured removably to brackets, which may be fastened to the forge frame or placed in any other location in the shop convenient to the operator.



Eye Bender



Angle Bender

HOW TO USE OIL STONES.

By the Pike Company.

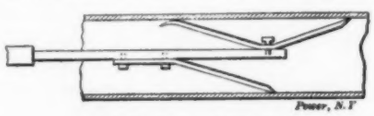
In using a stone care should be taken to retain the original life and sharpness of its grit, to keep its surface flat and even and to prevent its glazing. A new stone should be soaked in oil several days before using and, if kept in a dry place, it should be kept in a box with closed cover and a few drops of fresh clean oil left on it. Great care shuld always be taken to keep the stone clean and moist. Tools should be sharpened on the edge of the stone as well as in the middle. Coarse grained and all soft stones can be used successfully with water. Sperm oil is the best for all stones, though glycerine, diluted with either alcohol or turpentine, is a very fine lubricant, and particularly good to leave on a stone when putting it away to keep it moist and soft. If the stone become glazed or gummed up a good cleaning with turpentine will usually restore its cutting qualities, but if not, then scour the stone with sand stone and water or with sandpaper, fastened to a perfectly smooth board.

SMELTING BY ELECTRICITY.

An experimental plant for smelting by electricity is to be erected at Sault Ste. Marie, Mich., for the purpose of utilizing the power of Lake Superior's waters in converting the ore into iron and steel. The process is the invention of F. E. Hatch. During a long series of laboratory tests he has reduced many kinds of ore by electrolysis. He claims that all ores will submit to the process and at a saving over present methods of nearly half.

BOILER TUBE CLEANER.

Engineers having water tube boilers may find the accompanying sketch of some value, says a correspondent in Power: The scrapers are made of 3-16 inch flat steel, 1¼ inches wide. The double-ended one is loose on the handle, but kept in position by the screw. When forced into the tube, the rear end comes in contact with top of tube and so throws the cutting parts against the inner part of the tube. The scraper in the hands of two good men will do more and better work than some of the contrivances on the market for sale at a high price. The handle or shaft can be screwed into a piece of ½-inch pipe, long enough to reach through the tube. The result is sometimes surprising when it is pushed through a tube which seems to be clean.



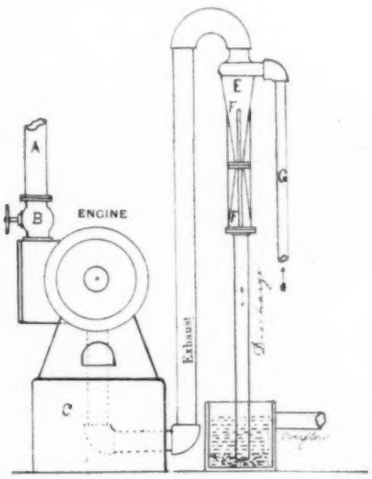
Power, N. Y.

BOILER TUBE CLEANER.

A condensing engine will require from twenty to twenty-five gallons of water to condense the steam evaporated from one gallon of water.

THE INJECTOR CONDENSOR.

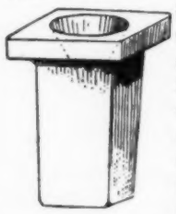
One of the simplest forms of a condensing engine is that fitted with the injector condenser. The accompanying cut shows a condenser of this type. The Practical Engineer describes the cut as follows: A, is the steam pipe; B, the stop valve; C, the exhaust pipe; E, the annular head into which the condensing water is thrown through the pipe, G, and by the arrangement of which the water is formed into a sheet; F F shows the two inverted nozzles through which the condensing water escapes into the hot well H. The method of operation of the injector condenser when the engine starts is as follows: The exhaust steam expels the air from the exhaust pipe and condenser; then a jet of cold water from a pump or tank creates a vacuum, which may be maintained by a head of water of 10 feet fall.



Injector Condensor

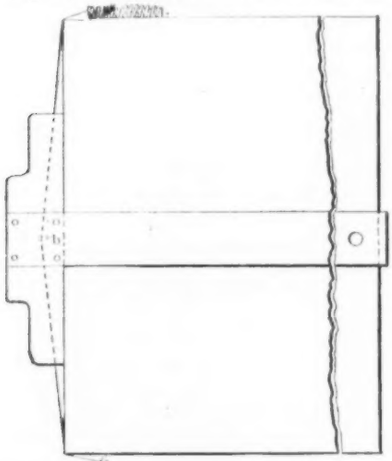
JUMPING UP IRON FOR WELDING.

The illustration shows an anvil tool which will be found useful in upsetting iron for welding, says the Australasian Carriagebuilder, Melbourne. Slightly point the end which is to be jumped up, and drive it into the tool. In this way the iron is jumped up a little way back from the point, where it is actually wanted, and saves time and labor hammering down the burr which forms when it is done in the usual way on the face of the anvil; besides, it is much easier to scarfe. Another idea sometimes adopted when welding axles or similar work is to get a strong ring which will just fit over the end to be jumped up. Place the ring, cold, on the anvil, and drive the heated end into it and jump up with the ring on. The ring will prevent the iron spreading at the bottom.



SIMPLE DRAWING BOARD ATTACHMENT.

A simple attachment for a drawing board, which I have noticed in our drawing room, may not be an original idea, but is very serviceable, says a writer in the American Machinist. The attachment is easily constructed.



Drawing Board Attachment

Attach a spring *a* to the top of the drawing board, then attach a piece of strong twine to the opposite end of spring; next pass it around both corners of the board having it perfectly tight, and fasten at the lower edge by means of a screw eye. Put a round-head screw *b* in the under side of the T-square head and insert twine in rear of the screw; the tension of the spring will then hold the head of the square against the edge of the board *c*, and many mistakes will be prevented, as the T-square is always true.

TO REMOVE PAINT BY SAND BLAST.

The ordinary gasoline blow torch commonly used in paint shops for removing old paint from cars and trucks preparatory to repainting, says the Automobile Review, is not only an inconvenient thing to handle but is constantly a menace to property and requires the strictest attention to prevent fires.

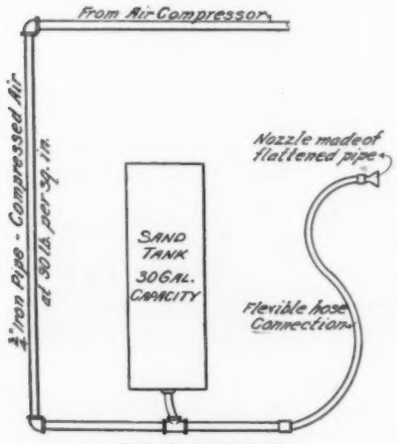

From Air Compressor
1" Iron Pipe - Compressed Air at 30 lbs. per Sq. In.
Nozzle made of flattened pipe
SAND TANK 30 GAL. CAPACITY
Flexible hose Connection

DIAGRAM OF SAND BLAST.

Mr. J. Millar, superintendent of rolling stock for the International Ry., of Buffalo, has abandoned the use of blow torches entirely in this work and now uses a home-made sand blast consisting of a sand tank, a few feet of ¾-inch iron pipe, and a nozzle made by flattening out a piece of ¾-inch iron pipe. Compressed air is taken through the iron pipe from an air compressor in the main shops. The sand which must be of fine clean quality is fed from the tank into the air pipe in the manner indicated in the diagram, the force of air combined with gravity, being sufficient to draw the sand down into the pipe in a good steady stream. By means of the flexible connection and nozzle one man directs the sand against the surface to be cleaned, exactly in the same way as he would handle a blow torch of any kind. Mr. Millar states that with an air pressure of approximately 90 lb. and a good quality of sand every particle of old paint is removed and a cleaner surface is secured than could be obtained with a blow-pipe flame, and in just one-half the time, inasmuch as one man now does the work formerly requiring the services of two men.

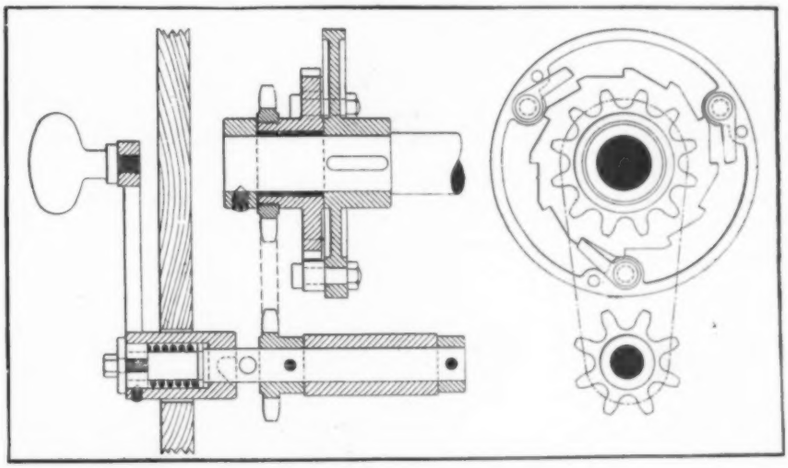
WHAT THE FLY-WHEEL IS FOR.

Increasing the size of a fly-wheel will not increase the amount of work your engine will do, says Practical Engineer. The function of the fly-wheel is to produce a uniform motion. When the engine is "on the center," practically all the moving force of the engine comes from momentum of the fly-wheel. When the full force of the pressure is upon the piston this force is obliged to overcome the inertia of the fly-wheel. In this way the excessive force moving the engine is decreased and the defective force increased at the proper time by the momentum of the fly-wheel, thus insuring a proper regulation of speed. The capacity of your engine is equal to the product of length of stroke, the area of the piston and the mean effective pressure multiplied by the number of revolutions per minute.

SIMPLE MOTOR STARTING DEVICE FOR AUTOS.

A querist to the Autumobile Review, who wished to construct a crank starter placed on a secondary shaft underneath the seat, and from which runs a chain to a ratchet on the motor shaft, the ratchet being constructed to run out of engagement as soon as the motor starts, was given the following directions:

A disk carrying three pawls is attached to the crank shaft of the motor, and a ratchet wheel carrying a sprocket of suitable size runs loosely also upon the motor crank shaft. An auxiliary shaft with a small sprocket operates the ratchet wheel by means of the starting handle. As soon as the motor attains its speed the pawls become disengaged from the ratchet wheel, and the centrifugal tendency keeps them out of contact with the wheel. To start the motor the handle is pressed inwardly, thus engaging the notch in the hub of the starting crank with the pin in the auxiliary shaft. The instant that the motor is started the notch in the hub of the starting crank is disengaged, thus preventing any back kick and liability of injury to the operator of the vehicle. After the motor is started the sprockets, chain and starting crank remain still. This device is superior to several in use on account of not being liable to transmit back kick in case the ignition is not properly retarded.



Showing the Crank Starter

It is claimed that in the waters of the state of Louisiana there are 450 square miles of oyster beds that are never raked over.

As a physical exerciser the old-fashioned wood-pile never had an equal.—The Chicago News.

Hurls Water to the Sky

Powerful Stream Produced by New System of Stationary Fire Pumps

In cities which have a large water front the days of the puffing, noisy, fire-spouting, smoke-puffing steam fire engine are numbered. They are to be supplanted by the system of large stationary pumps at the water's edge. Tide water cities will use salt water in extinguishing fires. Such wonderful force has been obtained in streams where the water was pumped by the stationary pumps and forced to the fire that the streams thrown by the most powerful of the old steam fire engines seem insignificant in comparison. To the top of tall sky-scrapers immense streams are hurled with tremendous energy. It is the system born of the age of the "sky-scraper" and the city with tall buildings is ill-protected unless it possesses the big stationary fire pumps.

Boston Special Water System. — A Fire Stream

The Fireman's Herald says: "This system, which is somewhat of the Holly direct-pumping plan, provides for a direct-pumping by sections, each section to be independent of the other but so arranged as to be connected if desired; the pressure at the hydrant outlet to be equal to or greater than that of a steam fire engine with extra large outlets and hose, the pumping engines to do the work now done by steam fire engines, hose wagons only to be used. This saves time in getting to work and in many ways it is a much better and quicker system than that of steam fire engines, and it is claimed to be much cheaper.

Boston is the first city to use the method for pumping salt water and there it has given splendid results and prevented many disastrous conflagrations. The system has reached its highest state of perfection in Philadelphia and as a result that city may now boast of being the best protected of any city in America. The Philadelphia mains are now supplied by the fire boats, but engines and pumps have been contracted for. There are now about seven and one-half miles of 8, 12 and 16-inch water mains, and 140 specially constructed hydrants, with two 4-inch outlets, each outlet supplying three lines of 2½-inch hose and each hydrant six lines. The mains are kept constantly full and under 80 pounds pressure, the reservoir supplying the fresh-water service now providing the pressure.

Boston Special Water System. — A Siamese Stream

The pumps ordered will have a 2,000,000-gallon per day capacity each, which will be driven by ten gas engines.

The system is but poorly developed in Chicago, and New York hasn't yet discovered it.

TINY MOTOR OF GREAT POWER.

Does Wonderful Work in Exhibition at Navy Department.

A motor power machine which, although powerful enough to run a steam launch, yet could be carried in a hat box, has been patented in America by Nicholas Jean Fortunesco, a Roumanian, and Alfred Georges, a Belgian. The machine is attracting much attention among the naval officials at Washington. An eight horse power machine built on the same scale, it is said, would weigh only 254 pounds and occupy comparatively no room at all and can be used for propulsion of vessels by direct transmission of power. This little rotary engine can be used any place where power is needed, and can be run by steam, compressed air, or water or with gas or liquified air. There is scarcely any machinery from a farm implement to a steamship which cannot be run by it. It has been tried in automobiles and runs smoothly without the slightest vibration of the vehicle such as is experienced in most of the machines. There is no fly wheel such as would interfere with the general application of the power of the machine and it can be used in propelling airships. It has been used in the generation of electricity on a large scale, but acted equally well when for house lighting it was worked by water pressure from an ordinary spigot. During its operation in the navy department it was illustrated that the little circular affair, scarcely bigger than a wash basin, could, while in any position whatever, either vertical or otherwise, be used with the same advantage as when standing in its proper position on the base constructed for it.

The Pacific Coast Railway Club has offered generous inducements to members of any railroad club in the United States to submit a paper pertaining to the construction, equipment, maintenance and management of steam railways.

WITHSTOOD ELECTRIC CURRENT OF ENORMOUS FORCE.

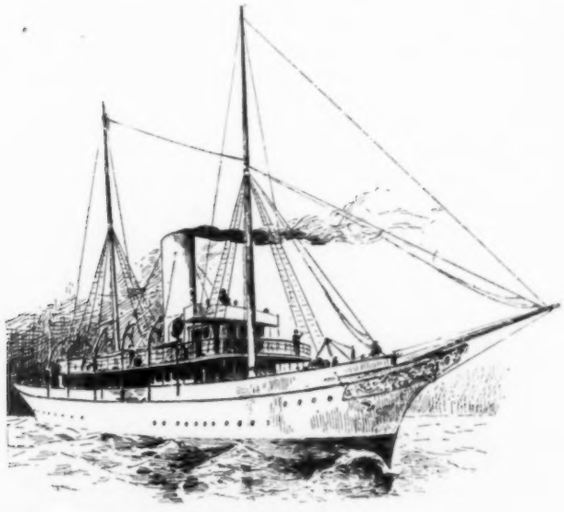
Performance of Prof. Artemieff Seemed Like a Miracle, But It Was Not.

In a recent test Prof. Artemieff, the well-known electrician, standing on the ground drew sparks from the secondary terminals of a transformer which was giving a tension of 75,000 volts, the period being 50 cycles per second. He next seized the main, and later on, the potential being raised to 150,000 volts, he drew sparks from both terminals and handled the latter. The machine supplying this transformer was of 170 kilowatt capacity. In concluding his experiments the professor short-circuited his generator by clutching hold of the terminals, the potential difference between the two being 1,000 volts, and the current passed 200 amperes. The circuit was broken by simply letting go of one electrode. Throughout these experiments Prof. Artemieff declared he felt not the slightest sensation of any current through his body.

The professor did not perform any miracle. He was simply clad in a new safety dress of his own invention, a device that is at present attracting much attention. The dress, which is entirely of fine, thickly woven wire gauze, completely encloses the wearer—hands, feet and head. It weighs but 3.3 pounds. The cooling surface is so great that a current of 200 amperes can pass through the dress for some seconds from hand to hand without perceptible heating effect.

HANDSOME BRITISH TURBINE YACHT.

Another handsome craft to grace the British waters is the turbine yacht "Emerald," which has just been completed by Messrs. A. Stephen & Sons, Ltd., Lighthouse. The yacht is owned by Sir Christopher Furness, M. P., from India, and has every appearance of a fine and able sea boat. Her principal dimensions are: Length, over all, 236 feet; length on water line, 198 feet; breadth, 28 feet, 8 inches, and depth, molded, 18 feet 6 inches. She is fitted with three turbines, driving three shafts, and has, in all, five propellers. The machinery was fitted by the Parsons Marine Steam Turbine Company, Ltd.



Turbine Yacht Emerald

Many churches in the central districts of London, each occupying ground worth a million dollars, have congregations on Sunday mornings of not more than a dozen persons, and usually half of them are curious Yankees.

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Since people have taken to using long distance telephone lines the companies have had different rates to collect. For a city line where the rate is five or ten cents, it was an easy matter, as the slots were made to take no other coin. To provide for various amounts, without the expense of a clerk to collect the money, automatic "pay stations" are now used. The one in the cut is made to receive 5, 10 or 25 cent pieces, but others will also receive 50 cents or a silver dollar. The button at the top is pressed to drop the money after it is put in the slot, and each button makes a different sound, by means of which the operator at the central office can tell just what has been paid.

Pay Station

NEW YORK'S SUBWAY IN THE AIR.

It was on a crosstown car in One Hundred and Twenty-fifth street, New York. Two housemaids were aboard. The younger of the two pointed out of the window suddenly and exclaimed:

"An' shure, now, wat be that ere bridge yonder?"

The elevated structure which is being built to connect the tracks of the underground railroad across the Manhattan Valley had called forth this outburst. Here on either side of this natural depression in Manhattan Island the subway had come to the surface to cross on an elevated structure.

"Oh, now, and wat be ye askin' seech a question," said the other; "don't ye know as that be the soobway?"

"Oh, faith, an' be that the soobway?" remarked the first speaker, somewhat overwhelmed by the answer she had received. "An' now, Oi wuz of a mind that the soobway wuz oonder the groond."

"Ah, faith, an' it be only in New Yoork that one be after seein' an underground railway up in the arr,' said the elder immigrant.

The new East and West Cuban railway, which is nearing completion, is 300 miles long.

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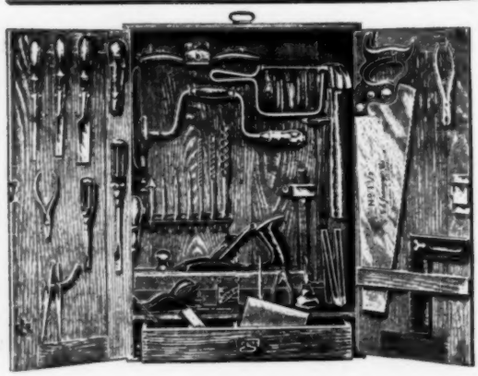

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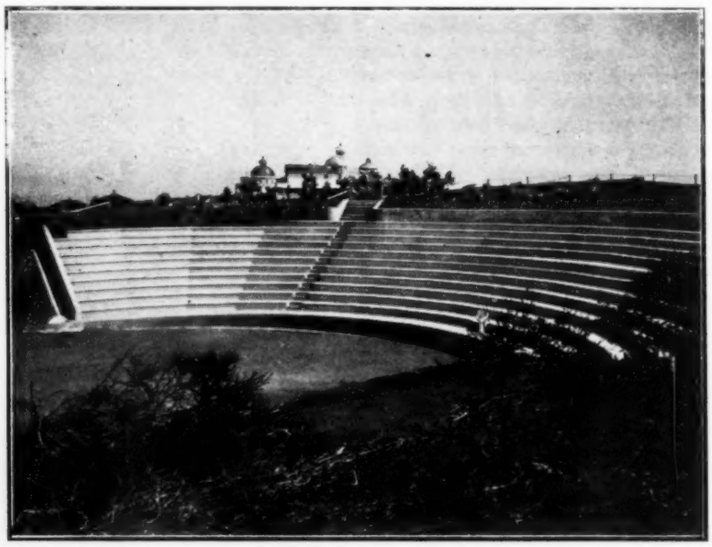
A great amphitheater of cement which makes the structure practically one mass of solid rock, has been built by the Theosophical Society at Point Loma, California. The mildness of the climate makes unnecessary any other roof than the bright blue sky. The seats rise one above another in terraces. The location chosen was a hillside. We are indebted to E. Duryee, of Colton, Cal., for a photgraph of the structure.

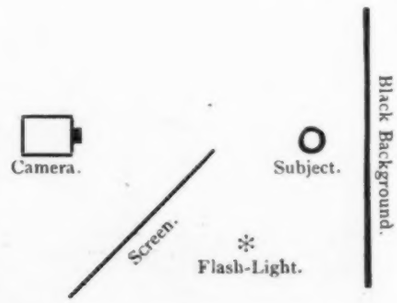


Cement Amphitheatre in California

A whistle and a code of signals to be used in emergency cases, such as drowning, fires, riotous crowds and for the quick assemblying of the life-saving crew, has been placed on the power house in Lincoln Park, Chicago.

FLASHLIGHT WORK.

The flash light enables the photographer to secure many pictures which could never be had in any other way. A writer in the Photo Era says: The manner of working is very simple and easily understood. The first thing to do is to decide from what point to illuminate the subject. To do this I darken the room, if the picture is to be made in the day time, placing the subject in the proper pose. Then with the aid of an assistant, having an oil lamp with a reflector, I take my stand at the camera. By directing the assistant to raise or lower the light, to move it to the right or left, you can judge of the illumination and secure just the effect you wish in your picture.



In making my pictures the background is always a plain, black felt screen, and the arrangement of camera, subject, screens and light as follows:

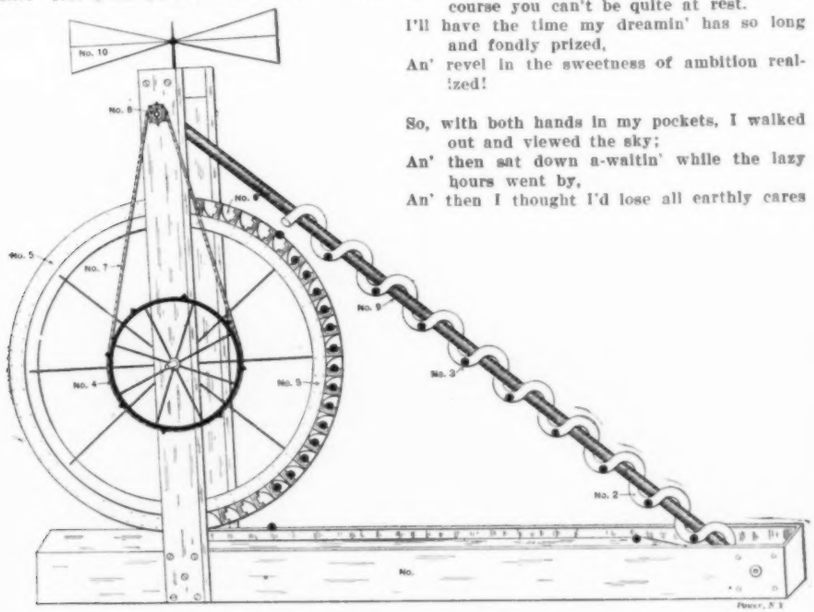
A screen is placed between the flash-light and the camera in such a position that the light will not reach the lense, or that the screen will not cut off part of the picture. The flash-lamp was raised about six feet from the floor. Any good flash-light lamp will answer. Do not forget that flash-light powder is dangerous, and must always be handled with caution.

RESEMBLES PERPETUAL MOTION.

William L. Dayton, of Austin, Texas, Rural Free Delivery Route No. 7, writes to Power:

"I have invented a self-running machine with a gain of power; two balls will pull three balls. See sketch.

No. 1 shows trough for ball to roll in. No. 2 shows screw pipe. No. 3 shows the balls. No. 4 shows the driven wheel. No. 5 shows the main power wheel. No. 6 shows cups on power wheel. No. 7 shows driven chain. No. 8 shows sprocket wheel. No. 9 shows shaft to revolve screw-pipe. No. 10 shows fan or governor to regulate speed. Now we will take all the balls No. 2 and put in the trough No. 1, then begin to turn the power wheel No. 5 with your hand until the cups No. 6 is filled with balls No. 3 then let the wheel go, and the machine will run itself with a gain of power. By using quicksilver instead of balls the machine gains more power. The journals are all ball bearings. Two men can push a box car on the track that 10 horses could not pull on the ground. If we had five tons of balls in the screwpipe one man could turn it. Now with five tons on the power wheel, how many horse power is that?"



Self-Running Machine

LOAFIN'.

One time I fixed my work all up. There wa'n't no chores to do,
Says I, I'll jes' enjoy a day of loafin' through and through;
I won't get up no picnics nor do any such fool thing,
A-botherin' with the victuals an' a-pushin' of the swing.
I won't do any readin', 'cause a book your mind will test,
An' when you're thinkin' thoughts, of course you can't be quite at rest.
I'll have the time my dreamin' has so long and fondly prized,
An' revel in the sweetness of ambition realized!

So, with both hands in my pockets, I walked out and viewed the sky;
An' then sat down a-waitin' while the lazy hours went by,
An' then I thought I'd lose all earthly cares in slumber deep,
An' that's the first time in my life I ever couldn't sleep.
I grabbed an ax an' jumped right in fur fair, a-choppin' wood,
To ease my nerves, an' nothin' ever done me so much good,
An' I've jes' about concluded, as I think it over anew,
That there ain't much fun in loafin'—'ceptin' when there's work to do.

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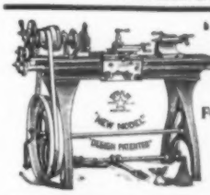
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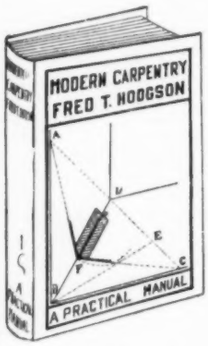

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